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63/1 (SEM-5) DSE1/CHMHE5016

2023

CHEMISTRY

Paper : CHMHE5016

(Analytical Methods in Chemistry)

Full Marks : 60

Pass Marks : 24

Time : Three hours

The figures in the margin indicate full marks for the questions.

1. Choose the correct answer : **(any five)**
1×5=5

(a) A measurement which on repetition gives same or nearly same result is called

(i) accurate measurement

(ii) precise measurement

(iii) estimated measurement

(iv) average measurement

Contd.

(b) Beer-Lambert law gives the relation between

(i) reflected radiation and concentration

(ii) scattered radiation and concentration

(iii) energy absorption and concentration

(iv) energy absorption and reflected radiation

(c) Which of the following statements is correct ?

(i) Microwave radiation possesses more energy than IR radiation.

(ii) IR has a shorter wavelength than visible light.

(iii) UV radiation has a longer wavelength than IR radiation.

(iv) IR radiation has a lower wavenumber than visible light.

(d) The instrument used in TGA is called

(i) thermogravimeter

(ii) thermobalance

(iii) thermometer

(iv) calorimeter

(e) Which of the following adsorbents used for column chromatography has maximum adsorptive power ?

(i) Silica gel

(ii) Magnesium oxide

(iii) Aluminium oxide

(iv) Calcium carbonate

(f) Overtones are mainly observed in

(i) near IR

(ii) mid IR

(iii) far IR

(iv) Not in IR region

(g) Possible transitions for water molecule in UV-visible region are

(i) $\sigma \rightarrow \sigma^*$

(ii) $n \rightarrow \pi^*, \pi \rightarrow \pi^*$

(iii) $\sigma \rightarrow \sigma^*, n \rightarrow \pi^*$

(iv) $n \rightarrow \sigma^*$

(h) Which of the following is not a fuel used in flame photometry ?

(i) Acetylene

(ii) Propane

(iii) Hydrogen

(iv) Camphor oil

(i) Chromatography is a physical method that is used to separate

(i) simple mixture

(ii) complex mixture

(iii) viscous mixture

(iv) metals

(j) In chromatography, which of the following can the mobile phase be made of

(i) solid or liquid

(ii) liquid or gas

(iii) gas only

(iv) liquid only

2. Answer the following questions : **(any five)**

2×5=10

(a) Write short notes on absolute error and relative error.

(b) Write the fundamental laws of spectroscopy.

(c) What is Nernst distribution law ?

(d) What is meant by thermal gravimetric analysis ? What is the basis of this analysis ?

(e) Give the advantages of LC-MS.

(f) *cis*-stilbene absorbs at lower wavelength than *trans*-stilbene in the UV-visible region of the electromagnetic spectrum. Why ?

(g) What are the limitations of Beer-Lambert law ?

3. Answer **any five** of the following questions :
5×5=25

(a) Describe gross sampling with special reference to the preparation of laboratory sample.

(b) Explain atomic spectra and its types with example of line spectra. Also explain the concept of adsorption and emission spectra.
1+2+2=5

(c) Define conductometry, conductance and conductivity. How is conductivity of a solution measured ?
(1+1+1)+2=5

(d) What is meant by solvent extraction ? How is it classified ? Describe the efficiency of its technique in terms of chelate formation.
1+1+3=5

(e) Describe various techniques of solvent extraction.

(f) Define ion exchange chromatography, cation exchange chromatography, and anion exchange chromatography. Give *one* example in each case.

(g) What is R_f value ? On which factors does the R_f value depend ? Give the application of paper chromatography.

1+2+2=5

(h) Discuss the methods for the preparation of solid sample in IR-spectroscopy.

(i) Write briefly about the classification of chromatographic techniques based on the mechanism of separation.

4. Answer **any two** of the following questions :
10×2=20

(a) Discuss the effect and importance of isotope substitution in IR-spectroscopy.

(b) How will you determine the pH of a solution by using hydrogen electrode ? Give its advantages and disadvantages.
6+(2+2)=10

(c) What is adsorption chromatography ? Give its mechanism. Also describe the mechanism in the ion-exchange and partition chromatography.

1+3+(3+3)=10

- (d) (i) Discuss the principle of conductometric titration for the determination of equivalent points in acid-base reaction. 5
- (ii) What are the key components of a thermal analysis system ? Discuss an application of Thermogravimetric Analysis (TGA) with a suitable example. 2+3=5
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